

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Original) A method for lightpath restoration in a reconfigurable optical network comprising the steps of:

assigning an IP address to each network addressable element in said reconfigurable optical network;

determining current topology of said reconfigurable optical network;

determining current resources in said reconfigurable optical network;

receiving a request to create a restorable lightpath from a source;

maintaining information regarding a state of said reconfigurable optical network;

selecting first route for data to be transmitted between said source and a destination based on said current resources of said reconfigurable optical network and said current topology of said reconfigurable optical network;

selecting at least one alternative route for data to be transmitted between said source and a destination based on said current resources of said reconfigurable optical network and said current topology of said reconfigurable optical network;

generating a first API call and corresponding lightpath request message to create a lightpath; generating a second API call and corresponding restoration reservation message to reserve lightpath restoration capacity;

forwarding said lightpath request message to each network addressable element along said selected first route;

forwarding said restoration reservation message to each network addressable element along said at least one alternative route;

selecting an output channel at each node to be used as an input channel at a next node for use on said selected first route;

reconfiguring an OLXC at an input channel at a current node connected to said output channel at said current node;

reserving necessary capacity at each node along said at least one alternative route;

receiving a response from said destination that said selected first route is available;

receiving a response from each said destination that restoration capacity is reserved for each link of said at least one alternative route; and

maintaining a restoration state at nodes traversed by said at least one alternative route.

2. (Original) The method according to claim 1, wherein said information regarding said restoration state of said reconfigurable optical network is distributed throughout said reconfigurable optical network.

3. (Original) The method according to claim 1, wherein said information regarding said restoration state of said reconfigurable optical network is maintained in a soft-state.

4. (Original) The method according to claim 1, further comprising the steps of:

updating said current topology of said reconfigurable optical network; and
updating said current resources of said reconfigurable optical network.

5. (Original) The method according to claim 4, wherein said current topology comprises:

an address for each node at each end of each link;
a total number of active channels on each link;
a number of allocated channels on each link;
a number of preemptable channels on each link;
a number of reserved restoration channel on each link;

Shared Risk Link Groups throughout the reconfigurable optical network;
and
optional physical layer parameters for each link.

6. (Original) The method according to claim 1, wherein a first-hop router selects said at least one alternative route.

7. (Original) The method according to claim 1, wherein said second selecting step further comprises the step of determining said at least one alternative route subject to a capacity that is available on each link in said reconfigurable optical network and further subject to a capacity reserved for restoration lightpaths.

8. (Original) The method according to claim 1, wherein restoration capacity is reserved such that for each given link along said selected first route there is at least one alternative route reserved that is completely link disjoint and Shared Risk Link Group disjoint from said given link along said selected first route.

9. (Original) The method according to claim 1, wherein when restoration resources are altered said determining step is repeated and further restoration capacity is reserved such that for each link along said selected first route there is at least one alternative route that is diverse from every other link within the same Shared Risk Link Group.

10. (Original) The method according to claim 1, wherein a single end-to-end alternative route is used to restore from all failures along the selected first route such that the single end-to-end alternative route is completely node and Shared Risk Link Group disjoint from the selected first route.

11. (Original) The method according to claim 1, wherein restoration resources may be optimized by repeating said determining step whereby further restoration capacity is reserved, wherein said reserving of further restoration capacity may include releasing a portion of said restoration capacity.

12. (Original) The method according to claim 1, wherein reserved restoration requirements for each link are stored locally at each link.

13. (Original) The method according to claim 1, wherein a total number of resources reserved for each link is a maximum over that required for all fiber span risk groups, thereby ensuring that restoration is guaranteed for all independent Shared Risk Link Group failures and that capacity is shared across said independent Shared Risk Link Group failures.

14. (Original) The method according to claim 1, wherein a total number of resources reserved for a given link for restoration is a maximum over all Shared Risk Link Groups of a sum of the resources required on the given link for a failure of all links within each Shared Risk Link Group.

15. (Original) The method according to claim 1, wherein reserved restoration capacity is advertised throughout said reconfigurable optical network.

16. (Original) The method according to claim 1, wherein for soft-state bandwidth management, a total restoration capacity reserved on a given link for a failure of a given Shared Risk Link Group within said reconfigurable optical network is a sum over all first-hop routers of a capacity required to support the failure of the given Shared Risk Link Group for all lightpaths managed by each first-hop router.

17. (Original) The method according to claim 4, wherein information regarding said current resources of said reconfigurable optical network and

information regarding said current topology of said reconfigurable optical network are distributed throughout said reconfigurable optical network.

18. (Original) A method for lightpath restoration in a reconfigurable optical network comprising the steps of:

assigning an IP address to each network addressable element in said reconfigurable optical network;

determining current topology of said reconfigurable optical network;

determining current resources in said reconfigurable optical network;

receiving a request to create a lightpath from a source;

selecting a first route for data to be transmitted between said source and a destination based on said current resources of said reconfigurable optical network and said current topology of said reconfigurable optical network;

selecting at least one alternative route for data to be transmitted between said source and a destination based on said current resources of said reconfigurable optical network and said current topology of said reconfigurable network;

selecting an output channel at each node to be used as an input channel at a next node for use on said selected first route;

reconfiguring an OLXC at an input channel at a current node connected to said output channel at said current node;

generating a first API call and a corresponding lightpath request message to create a lightpath;

generating a second API call and a corresponding restoration reservation message to reserve lightpath restoration capacity;

forwarding said lightpath request message to each network addressable element along said selected first route;

forwarding said restoration reservation message to each network addressable element along said at least one alternative route;

receiving a response from said destination that said selected first route is available;

receiving a response from each said destination that restoration capacity is not available on some link along said at least one alternative route and said restoration capacity cannot be reserved for every link of said at least one alternative route; and

releasing resources configured and reserved along a partially created lightpath.

19. (Original) The method according to claim 18, wherein a first-hop router selects said at least one alternative route.

20. (Original) The method according to claim 18, wherein said second selecting step further comprises the step of determining said at least one alternative route subject to a capacity that is available on each link in said reconfigurable optical network and further subject to a capacity reserved for restoration lightpaths.

21. (Original) The method according to claim 18, wherein restoration capacity is reserved such that for each given link along said selected first route there is at least one alternative route reserved that is completely link disjoint and Shared Risk Link Group disjoint from said given link along said selected first route.

22. (Original) The method according to claim 18, wherein when restoration resources are altered said determining step is repeated and further restoration capacity is reserved such that for each link along said selected first route there is at least one alternative route that is diverse from every other link within the same Shared Risk Link Group.

23. (Original) The method according to claim 18, wherein said reserved restoration resource requirements for each link are stored locally at each node.

24. (Original) The method according to claim 18, wherein a total number of resources reserved for each link is a maximum over that required for all fiber span risk groups, thereby ensuring that restoration is guaranteed for all independent Shared Risk Link Group failures and that capacity is shared across said independent Shared Risk Link Group failures.

25. (Original) The method according to claim 18, wherein a total number of resources reserved for a given link for restoration is a maximum over all Shared Risk Link Groups of a sum of the resources required on the given link for a failure of all links within each Shared Risk Link Group.

26. (Original) The method according to claim 18, wherein restoration capacity is advertised throughout said reconfigurable optical network.

27. (Canceled)

28. (Original) A system for lightpath restoration in a reconfigurable optical network comprising:

means for assigning an IP address to each network addressable element in said reconfigurable optical network;

means for determining current topology of said reconfigurable optical network;

means for determining current resources in said reconfigurable optical network;

means for receiving a request to create a restorable lightpath from a source;

means for maintaining information regarding a state of said reconfigurable optical network; means for selecting a first route for data to be transmitted between said source and a destination based on said current resources of said reconfigurable optical network and said current topology of said reconfigurable optical network;

means for selecting at least one alternative route for data to be transmitted between said source and a destination based on said current resources of said reconfigurable optical network and said current topology of said reconfigurable optical network;

means for generating a first API call and a corresponding lightpath request message to create a lightpath;

means for generating a second API call and a corresponding restoration reservation message to reserve lightpath restoration capacity;

means for forwarding said lightpath request message to each network addressable element along said selected first route;

means for forwarding said restoration reservation message to each network addressable element along said at least one alternative route;

means for selecting an output channel at each node to be used as an input channel at a next node for use on said selected first route;

means for reconfiguring an OLXC at an input channel at a current node connected to said output channel at said current node;

means for reserving necessary capacity for said at least one alternative route;

means for receiving a response from said destination that said selected first route is available;

means for receiving a response from each said destination that restoration capacity is reserved for each link of said at least one alternative route; and

means for maintaining a restoration state at nodes traversed by said at least one alternative route.

29. (Original) The system according to claim 28, wherein a first-hop router selects said at least one alternative route.

30. (Original) The system according to claim 28, wherein said second means for selecting further comprises means for determining said at least one alternative route subject to a capacity that exists on each link in said

reconfigurable optical network and further subject to a capacity reserved for restoration lightpaths.

31. (Original) The system according to claim 28, wherein restoration capacity is reserved such that for each given link along said selected first route there is at least one alternative route reserved that is completely link disjoint and Shared Risk Link Group disjoint from said given link along said selected first route.

32. (Original) The system according to claim 28, wherein when restoration resources are altered said determining step is repeated and further restoration capacity is reserved such that for each link along said selected first route there is at least one alternative route that is diverse from every other link within the same Shared Risk Link Group.

33. (Original) The system according to claim 28, wherein a single end-to-end alternative route is used to restore from all failures along the selected first route such that the single end-to-end alternative route is completely node and Shared Risk Link Group disjoint from the selected first route.

34. (Original) The system according to claim 28, wherein restoration resources may be optimized by repeating said determining step whereby further restoration capacity is reserved, wherein said reserving of further restoration capacity may include releasing a portion of said restoration capacity.

35. (Original) The system according to claim 28, wherein reserved restoration requirements for each link are stored locally at each link.

36. (Original) The system according to claim 28, wherein a total number of resources reserved for each link is a maximum over that required for all fiber span risk groups, thereby ensuring that restoration is guaranteed for all

independent Shared Risk Link Group failures and that capacity is shared across said independent Shared Risk Link Group failures.

37. (Original) The system according to claim 28, wherein a total number of resources reserved for a given link for restoration is a maximum over all Shared Risk Link Groups of a sum of the resources required on the given link for a failure of all links within each Shared Risk Link Group.

38. (Original) The system according to claim 28, wherein reserved restoration capacity is advertised throughout said reconfigurable optical network.

39. (Original) The system according to claim 28, wherein said information regarding said restoration state of said reconfigurable optical network is maintained in a soft-state.

40. (Original) The system according to claim 28, wherein for soft-state bandwidth management, a total restoration capacity reserved on a given link for a failure of a given Shared Risk Link Group within said reconfigurable optical network is a sum over all first-hop routers of a capacity required to support the failure of the given Shared Risk Link Group for all lightpaths managed by each first-hop router.

41. (Original) The system according to claim 28, further comprising:
means for updating said current topology of said reconfigurable network;
and
means for updating said current resources of said reconfigurable optical network.

42. (Original) The system according to claim 40, wherein information regarding said current resources of said reconfigurable optical network and information regarding said current topology of said reconfigurable optical network

are distributed throughout said reconfigurable optical network.

43. (Original) The system according to claim 28, wherein said information regarding said restoration state of said reconfigurable optical network is distributed throughout said reconfigurable optical network.

44. (Original) A system for lightpath restoration in a reconfigurable optical network comprising:

- means for assigning an IP address to each network addressable element in said reconfigurable optical network;

- means for determining current topology of said reconfigurable optical network;

- means for determining current resources in said reconfigurable optical network;

- means for receiving a request to create a lightpath from a source;

- means for selecting a first route for data to be transmitted between said source and a destination based on said current resources of said reconfigurable optical network and said current topology of said reconfigurable optical network;

- means for selecting at least one alternative route for data to be transmitted between said source and a destination based on said current resources of said reconfigurable optical network and said current topology of said reconfigurable network;

- means for selecting an output channel at each node to be used as an input channel at a next node for use on said selected first route;

- means for reconfiguring an OLXC at an input channel at a current node connected to said output channel at said current node;

- means for generating a first API call and a corresponding lightpath request message to create a lightpath; means for generating a second API call and a corresponding restoration reservation message to reserve lightpath restoration capacity;

means for forwarding said lightpath request message to each network addressable element along said selected first route;

means for forwarding said restoration reservation message to each network addressable element along said at least one alternative route;

means for receiving a response from said destination that said selected first route is available;

means for receiving a response from each said destination that restoration capacity is not available on some link along said at least one alternative route and said restoration capacity cannot be reserved for every link of said at least one alternative route; and

means for releasing resources configured and reserved along a partially created lightpath.

45. (Original) The system according to claim 44, wherein a first-hop router selects said at least one alternative route.

46. (Original) The system according to claim 44, wherein said second means for selecting further comprises means for determining said at least one alternative route subject to a capacity that is available on each link in said reconfigurable optical network and further subject to a capacity reserved for restoration lightpaths.

47. (Original) The system according to claim 44, wherein restoration capacity is reserved such that for each given link along said selected first route there is at least one alternative route reserved that is completely link disjoint and Shared Risk Link Group disjoint from said given link along said selected first route.

48. (Original) The system according to claim 44, wherein when restoration resources are altered said means for determining is repeated and further restoration capacity is reserved such that for each link along said selected first

route there is at least one alternative route that is diverse from every other link within the same Shared Risk Link Group.

49. (Original) The system according to claim 44, wherein said reserved restoration resource requirements for each link are stored locally at each node.

50. (Original) The system according to claim 44, wherein a total number of resources reserved for each link is a maximum over that required for all fiber span risk groups, thereby ensuring that restoration is guaranteed for all independent Shared Risk Link Group failures and that capacity is shared across said independent Shared Risk Link Group failures.

51. (Original) The system according to claim 44, wherein a total number of resources reserved for a given link for restoration is a maximum over all Shared Risk Link Groups of a sum of the resources required on the given link for a failure of all links within each Shared Risk Link Group.

52. (Original) The system according to claim 44, wherein restoration capacity is advertised throughout said reconfigurable optical network.

53. (Original) The system according to claim 44, wherein said current topology comprises:

- an address for each node at each end of each link;
 - a total number of active channels on each link;
 - a number of allocated channels on each link; a number of preemptable channels on each link;
 - a number of reserved restoration channel on each link;
 - Shared Risk Link Groups throughout the reconfigurable optical network;
- and
- optional physical layer parameters for each link.

54. (Canceled)

55. (Canceled)

56. (Currently amended) A The method for lightpath restoration in a reconfigurable optical network comprising the steps of according to claim 55,
~~wherein the step of reserving restoration capacity further comprises the steps of:~~

assigning an IP address to each network addressable element in said reconfigurable optical network;

determining current topology of said reconfigurable optical network;

determining current resources in said reconfigurable optical network;

receiving a request to create a lightpath from a source;

maintaining information regarding a state of said reconfigurable optical network;

selecting a first route for data to be transmitted between said source and a destination based on said current resources of said reconfigurable optical network and said current topology of said reconfigurable optical network;

selecting at least one alternative route for data to be transmitted between said source and a destination based on said current resources of said reconfigurable optical network and said current topology of said reconfigurable optical network;

generating a first API call and corresponding lightpath request message to create a lightpath;

generating a second API call and corresponding restoration reservation message to reserve lightpath restoration capacity;

forwarding said lightpath request message to each network addressable element along said selected first route;

forwarding said restoration reservation message to each network addressable element along said at least one alternative route;

selecting an output channel at each node to be used as an input channel at a next node for use on said selected first route;

reconfiguring an OLXC at an input channel at a current node connected to said output channel at said current node;

reserving necessary capacity on each link of said at least one alternative route;

receiving a response from said destination that said selected route is available;

receiving a response from each said destination that restoration capacity is reserved and for each channel on each link of said at least one alternative route;

maintaining a restoration state at nodes traversed by said at least one alternative route;

detecting transmission failures in said reconfigurable optical network;

handling exceptions as a result of transmission failures; and
allocating said restoration capacity.

57-65. (Canceled)

66. (Currently amended) The A system for lightpath restoration in a reconfigurable optical network comprising according to claim 64, wherein the means for reserving restoration capacity further comprises:

means for assigning an IP address to each network addressable element in said reconfigurable optical network;

means for determining current topology of said reconfigurable optical network;

means for determining current resources in said reconfigurable optical network;

means for receiving a request to create a lightpath from a source;

means for maintaining information regarding a state of said reconfigurable optical network;

means for selecting a first route for data to be transmitted between said source and a destination based on said current resources of said reconfigurable

optical network and said current topology of said reconfigurable optical network;

means for selecting at least one alternative route for data to be transmitted between said source and a destination based on said current resources of said reconfigurable optical network and said current topology of said reconfigurable optical network;

means for generating a first API call and corresponding lightpath request message to create a lightpath;

means for generating a second API call and corresponding restoration reservation message to reserve lightpath restoration capacity;

means for forwarding said lightpath request message to each network addressable element along said selected first route;

means for forwarding said restoration reservation message to each network addressable element along said at least one alternative route;

means for selecting an output channel at each node to be used as an input channel at a next node for use on said selected first route;

means for reconfiguring an OLXC at an input channel at a current node connected to said output channel at said current node;

means for reserving necessary capacity on each link of said at least one alternative route;

means for receiving a response from said destination that said selected route is available;

means for receiving a response from each said destination that restoration capacity is reserved for each channel on each link of said at least one alternative route; and

means for maintaining a restoration state at nodes traversed by said at least one alternative route;

means for detecting a transmission failure in said reconfigurable optical network;

means for handling an exception as a result of a transmission failure; and

means for allocating said restoration capacity.

67-83. (Canceled)

84. (Canceled)

85-90. (Canceled)

91. (Canceled)